

ARMY RESEARCH LABORATORY



Bradley Fire Support Vehicle (BFIST) Demonstrator Task List

Michael M. Copenhaver

John C. Lowry

Calvin DeWitt

CAE-Link Corporation

James J. Williams
U.S. Army Research Laboratory

ARL-TN-76

AUGUST 1996

DTIC QUALITY INSPECTED 2

Approved for public release; distribution is unlimited.

19960924 068

The findings in this report are not to be construed as an official Department of the Army position
unless so designated by other authorized documents.

Citation of manufacturer's or trade names does not constitute an official endorsement or approval of
the use thereof.

Destroy this report when it is no longer needed. Do not return it to the originator.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

| | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------|
| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED | |
| | August 1996 | Final | |
| 4. TITLE AND SUBTITLE Bradley Fire Support Vehicle (BFIST) Demonstrator Task List | | | 5. FUNDING NUMBERS PR: 1L162716AH70 PE: 6.27.16 |
| 6. AUTHOR(S) Copenhaver, M.M.; Lowry, J.C.; DeWitt, C.; Williams, J.J. | | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Human Research & Engineering Directorate ATTN AMSRL HR MF Fort Sill, OK 73503-5600 | | | 8. PERFORMING ORGANIZATION REPORT NUMBER |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Human Research & Engineering Directorate Aberdeen Proving Ground, MD 21005-5425 | | | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER ARL-TN-76 |
| 11. SUPPLEMENTARY NOTES | | | |
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited. | | | 12b. DISTRIBUTION CODE |
| 13. ABSTRACT (Maximum 200 words) The Department of the Army is acquiring the Bradley fire support vehicle (BFIST) to replace the M981 fire support team vehicle (FISTV). This is the first of two reports that address BFIST demonstrator manpower and personnel integration (MANPRINT) issues. It presents an operator task list for the BFIST demonstrator, along with a description of the methodology used to develop the task list. This task list provides the United States Army Field Artillery School (USAFA) with a detailed description of the missions, mission segments, functions, and tasks required for operation of the BFIST demonstrator. The task list is also the basis for a series of human performance simulation models developed in the next report. | | | |
| 14. SUBJECT TERMS BFIST demonstrator fire support | | | 15. NUMBER OF PAGES 55 |
| fire support vehicle HARDMAN III | | | 16. PRICE CODE |
| operator tasks task list | | | |
| 17. SECURITY CLASSIFICATION OF REPORT Unclassified | 18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified | 20. LIMITATION OF ABSTRACT 298-102 |

BRADLEY FIRE SUPPORT VEHICLE (BFIST) DEMONSTRATOR TASK LIST

Michael M. Copenhaver
John C. Lowry
Calvin DeWitt
James J. Williams

August 1996

APPROVED:



ROBIN L. KEESEE
Director, Human Research &
Engineering Directorate

Approved for public release; distribution is unlimited.

U.S. ARMY RESEARCH LABORATORY

Aberdeen Proving Ground, Maryland

FOREWORD

The Department of the Army is acquiring the Bradley fire support vehicle (BFIST) to replace the M981 fire support team vehicle (FISTV) currently in use. The BFIST acquisition has recently proceeded through Milestone Decision II, April 1995.

The following BFIST demonstrator crew task list incorporates the design projections that were available during the first and second quarter of fiscal year (FY) 1994. The BFIST demonstrator crew task list presented in this report was based on

1. The tasks performed by the current M981 FISTV crew,
2. Operations and lessons learned of the BFIST demonstrator as it participated in on-site tests and demonstrations at Fort Sill, Oklahoma, 1 September to 10 December 1993, and the 94-07 rotation at the National Training Center, and
3. Design enhancements as projected by subject matter experts (SMEs) at the U.S. Army Field Artillery School (USAFAS) Fire Support and Combined Arms Operations Department and the USAFAS Directorate of Combat Developments during the last quarter FY 93 and first two quarters of FY 94.

This is the first of two reports. Presented in the other report are the results from human performance simulation modeling that address manpower and personnel issues pertaining to the BFIST acquisition. The task list presented in this report is the basis for the human performance simulation models.

CONTENTS

| | |
|-------------------------------------------------------------------------------------|----|
| INTRODUCTION | 3 |
| METHODOLOGY FOR PREPARING THE TASK LIST | 4 |
| Framework for the Analysis | 4 |
| Using a Controlled Vocabulary | 4 |
| Data Collection Approach | 5 |
| Selection of Missions, Mission Segments, and Functions | 7 |
| Task Description | 7 |
| SUMMARY AND CONCLUSION | 14 |
| REFERENCES | 17 |
| BIBLIOGRAPHY | 19 |
| APPENDICES | |
| A. BFIST Demonstrator Task List | 21 |
| B. Acronyms and Abbreviation List | 47 |
| DISTRIBUTION LIST | 51 |
| FIGURES | |
| 1. Systematic Approach to the Preparation of the BFIST Demonstrator Task List | 5 |
| 2. The Role of HARDMAN III in BFIST Acquisition | 15 |
| TABLES | |
| 1. BFIST (FIST and COLT) Missions and Mission Segments | 7 |
| 2. Verb Taxonomy for Perceptual Behaviors | 10 |
| 3. Verb Taxonomy for Cognitive Behaviors | 11 |
| 4. Verb Taxonomy for Motor Behaviors | 12 |
| 5. Verb Taxonomy for Communications Behaviors | 13 |
| 6. Verb Taxonomy for Maintenance Tasks | 13 |

BRADLEY FIRE SUPPORT VEHICLE (BFIST) DEMONSTRATOR TASK LIST

INTRODUCTION

The Department of Army is acquiring a new fire support vehicle, which is intended to overcome several limitations of the predecessor system, the M981 fire support team vehicle (FISTV). Specific shortcomings of the FISTV that will be addressed by the new acquisition include (a) inadequate self-protection; (b) an easily recognizable profile; (c) a lack of automated displays for situational awareness and target location; and (d) unreliable subsystems such as the north-seeking gyrocompass (NSG) and the carrier engine. The Bradley fire support vehicle (BFIST) (the new acquisition) will be designed to correct the limitations of the M981 FISTV through moderate system upgrades and incorporation of existing technologies.

System developers rely on modeling and simulation to support design decisions early in the acquisition of a new system. Impact estimates with respect to the manpower, personnel, and training domains of manpower and personnel integration (MANPRINT) are required for new systems. To develop such estimates, the U.S. Army Research Laboratory (ARL) has developed the hardware versus manpower (HARDMAN) III set of interrelated human performance computer simulation modeling tools. HARDMAN III is particularly suited for the prediction of mission time, mission aborts, human reliability, and human workload associated with task performance.

The first step in developing any simulation model is preparing a task list. An analysis was performed using the available data and documentation and conducting subject matter expert (SME) interviews. As a result of this analysis, a task list was developed and refined for use in generating the HARDMAN III models. The models, in turn, will provide a technical basis for answering the following research questions:

1. What is the optimum crew structure for conducting fire support team (FIST) and combat observation lasing team (COLT) missions in the BFIST demonstrator?
2. What impact will crew configuration and task allocation have on crew workload and performance?
3. How will personnel characteristics such as aptitude affect crew performance?

The purpose of this report is to present the BFIST demonstrator task list (see Appendix A) and the methodology used to develop it.

METHODOLOGY FOR PREPARING THE TASK LIST

Framework for the Analysis

The technical approach to preparing the BFIST demonstrator task list involved a top-down analysis of BFIST missions, mission segments, functions, and tasks. Missions, mission segments, functions, and tasks data were defined, based on a thorough consideration of several relevant sources including

- The BFIST requirements documents,
- AirLand operations concepts applicable to the fire support mission,
- Fire support tactics, techniques, and procedures, and
- Briefings and interviews with SMEs from the United States Army Field Artillery

School (USAFAS)

The sequence of tasks identified through this formal decomposition shows the flow of tasks required to complete a given function. This effort results in a four-level task list format, as follows:

- Level One (1) - Missions,
- Level Two (2) - Mission segments,
- Level Three (3) - Functions, and
- Level Four (4) - Tasks.

Using a Controlled Vocabulary

Many different techniques have been used to acquire, record, report, and format task descriptions. However, in most instances, such efforts have been weakened by the lack of a standard vocabulary in the task descriptions. Without a standard set of words and terms, different analysts may use different terms to describe the same task. To minimize this variability, Lowry and Wilkinson (1993) developed a verb taxonomy representing a controlled vocabulary based on the Berliner taxonomy (Berliner, Angel, & Shearer, 1964). The same controlled vocabulary was used to prepare BFIST demonstrator task descriptions for the present study.

Data Collection Approach

The approach to data collection for the preparation of the BFIST demonstrator task list is divided into three phases: tabletop analysis, on-site reviews, and data entry. The steps performed for each phase are presented in Figure 1. A detailed description of each of the three phases of the data collection process is given next.

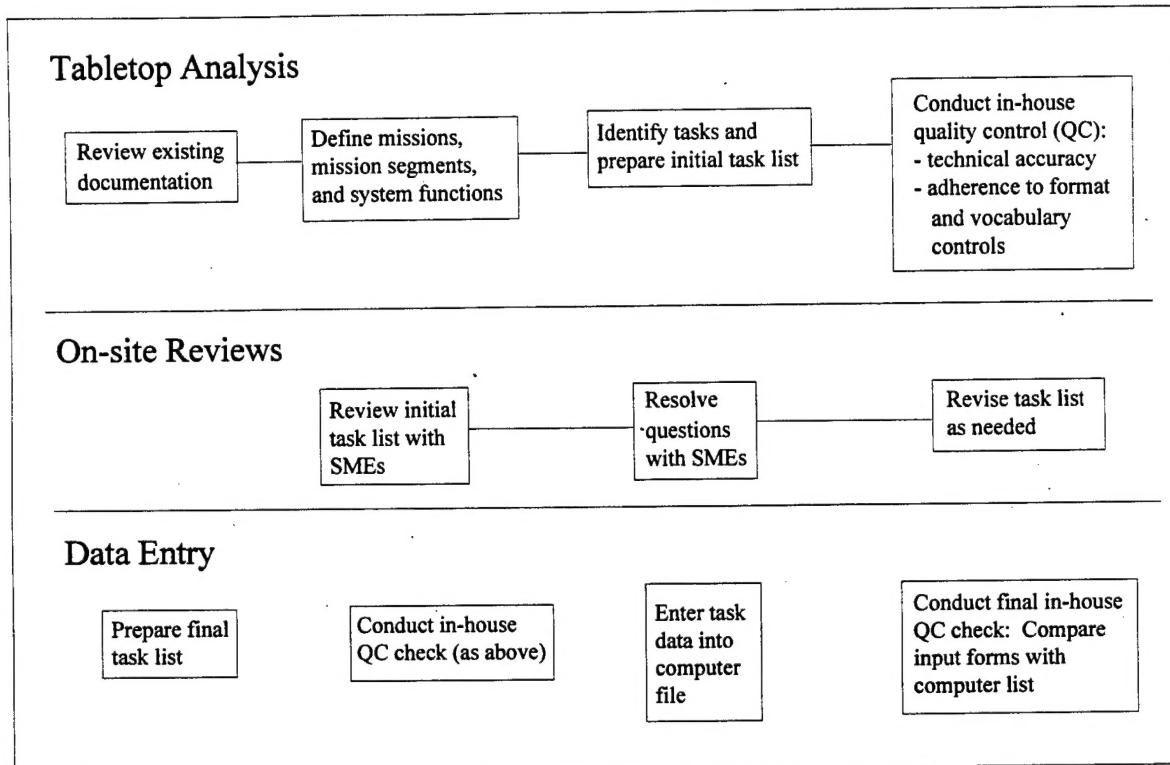


Figure 1. Systematic approach to the preparation of the BFIST demonstrator task list.

Tabletop Analysis

The first step in the tabletop analysis was to obtain and review available documentation for information relevant to the BFIST system and task performance. The available documentation was composed of two types of information: (a) the BFIST operational requirements and (b) background. The BFIST requirements and additional background information were extracted from the documentation shown in the bibliography of this report.

The second step in the tabletop analysis was to use the available documentation to define initial BFIST missions, mission segments, and functions that are inclusive of BFIST

operations. Consideration was given to the BFIST operational requirements documentation, fire support in AirLand battle operations, and prior task lists in identifying suitable mission and function data.

The third step in the tabletop analysis was the identification of the initial tasks associated with the functions listed in the mission-mission segment-function-task outline. The tasks (Level 4) were listed under associated functions. This activity resulted in the draft version of the BFIST demonstrator task list.

The final step in the tabletop analysis was to conduct the first quality control (QC) check of the draft version of the task list. A variety of QC checks were performed at each step in the analysis. These efforts included examination of the completeness and accuracy of

- available documentation,
- information pertaining to BFIST operation and maintenance, and
- task identification and description.

On-site Reviews

Phase 2, the on-site reviews, provided a forum for assessing the technical adequacy and accuracy of the task list (including its format and structure). Figure 1 identifies the steps included in the on-site reviews. The first activity involved individual reviews by SMEs at the USAFAS. Then a SME working group session was conducted at Ft. Sill as well as follow-up interviews. Finally, an informal review session was conducted to obtain specific feedback from SMEs about the accuracy and adequacy of the task list.

Data Entry

Phase 3, data entry, involved final revisions, quality checks, and final preparation of the BFIST demonstrator task list. The steps involved in final preparation are shown in Figure 1. Preparation of the final version of the BFIST demonstrator task list incorporates all comments received from SMEs. Final revisions and QC checks (applying the same QC criteria as applied during the tabletop analysis) were conducted to bring the task list into compliance with USAFAS direction received during the review session.

Selection of Missions, Mission Segments, and Functions

Documents listed in the bibliography were perused to identify missions, mission segments, and functions. Table 1 lists the missions and mission segments identified in the final version of the BFIST demonstrator task list. The list of the BFIST functions is too lengthy to represent in this table (see Appendix A for the complete list).

Table 1

BFIST (FIST and COLT) Missions and Mission Segments

| Missions | FISTV mission segments |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operate system | Receive fragmentary order (FRAGO) Prepare for operations Prepare for movement Drive-navigate the BFIST Conduct recovery operations Direct a deliberate position occupation Move from a prepared position Perform a hasty occupation |
| Conduct fire support | Receive planning guidance Advise company commander Plan fire support Coordinate - brief - rehearse fire plan Perform quick (hasty) fire planning Controls - coordinates fires |
| Engage targets | Direct field artillery fires Direct other supporting fires Conduct Copperhead missions |
| Ensure survivability | Conduct smoke operations Conduct nuclear, biological, and chemical (NBC) defensive operations Treat-evacuate injured Perform after preventive maintenance checks and services (PMCS) |

Task Description

As mentioned earlier, a controlled vocabulary was used to prepare task statements for the BFIST demonstrator task list. The grammar defines the structure, format, and content of the task statement. The result is a task statement sentence. As with standard English sentences, the task statement sentence includes various parts of speech, including as a minimum (a) subject, (b)

(action) verb, and (c) object (of the action). Additional parts of speech may include object modifiers and subordinate clauses that, for example, clarify the action described by the task statement. The task statement sentence may therefore be read as a standard English sentence.

The task statement sentence used in the preparation of the BFIST demonstrator task list follows the form:

<Subject> + Action Verb + Object of action + <modifier> + <subordinate clause>.

The “<#####>“ convention used above denotes a part of speech that is optional or left blank (meaning assumed) for the purposes of task description. Using this structure, a task statement is only required to contain an action verb and object of action. An example of a task statement using this structure is

Receives approval.

The meaning of this task can be refined by adding more information. For example, an object modifier may be added:

Receives approval for fire plan.

A subordinate clause can be added to further clarify the task, such as

Receives approval for fire plan from battalion fire support officer (FSO).

A subject can be added:

SGT receives approval for fire plan from battalion FSO.

All tasks contained in the task list followed this grammatical structure. Each of the parts of speech in the task statement sentence, as well as the role and use of each part of speech is discussed next.

Subject

For the purposes of the BFIST demonstrator task list, the performer (subject) of the task is not identified. The assignment of task performer is a result of an allocation of the task to individual BFIST crew members, which will be performed in the crew configuration portion of the BFIST HARDMAN III analyses.

Action Verb

The action verb is a descriptor of task behavior. It describes the crew member's behavior. A standard verb vocabulary has been established for standardizing the descriptions of actions performed in a BFIST. The modified classifications, known now as the verb taxonomy, are shown in Tables 2 through 6. The action verbs (identified as specific behaviors in the Tables 2 through 5 or as maintenance tasks in Table 6) are grouped into processes. The five processes include

- Perceptual in Table 2,
- Cognitive in Table 3,
- Motor in Table 4,
- Communications in Table 5, and
- Maintenance in Table 6.

Four of these processes are subdivided into activities or maintenance type. The first column in Tables 2, 3, 4, and 6 identifies these activities or maintenance type. For example, perceptual processes include two activities: (a) searching for and receiving information, and (b) identifying objects, actions, and events. Specific behaviors (action verbs) associated with these perceptual processes are assigned to one of these two activities. The second column (first column in Table 5) identifies the specific action verb (either a behavior or maintenance task) associated with each activity, maintenance type, or process. The third column (second column in Table 5) defines the action verb. In some cases, more than one definition is necessary.

Some action verbs apply only during special circumstances. For example, definitions of action verbs that are followed by “[Computer]” are interpreted as behaviors that occur only in the presence of a human-computer interface. Other special situations apply to action verbs assigned to the communications process. Definitions of action verbs that are followed by “[Voice, FM Radio, FM Digital]” are interpreted as behaviors that occur only in the presence of digital or voice communications media.

Object of Action

The object of the action described in the task statement is the component, parameter, or other condition to which the task behavior is directed. Identification of the object of action will generally have two parts:

(1) Identification of the specific component, parameter, and state of the parameter, and

(2) Identification of the related system (subsystems) of which it is a part.

Table 2

Verb Taxonomy for Perceptual Behaviors

| Activities | Specific behaviors | Definitions |
|------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Searching for and receiving information | Detects | (a) Become aware of the presence or absence of a physical stimulus. (b) Recognize the occurrence of a specific condition. (c) Discover or notice an occurrence (usually unsolicited). |
| | Inspects | Examine carefully, or to view closely with critical appraisal. |
| | Listens | (a) Pay attention for the purpose of hearing. (b) Wait attentively for a specific sound. |
| | Monitors | Keep track of overtime. |
| | Observes | Attend visually to the presence or current status of an object, indication, or event. |
| | Reads | Examine visually, information that is presented symbolically. |
| | Receives | Read or hear a communication. |
| | Scans | (a) Quickly examine displays or other information sources to obtain a general impression. [Computer] (b) Non-directed viewing of many classes of objects. (c) Glance over quickly, usually looking for overall patterns or anomalous occurrences (not details). |
| | Discriminates | Roughly classify or differentiate an entity in terms of a gross level grouping or set membership-frequently on the basis of a limited number of attributes. |
| | Identifies | Recognize the nature of an object or indication according to implicit or predetermined characteristics. |
| Identifying objects, actions, and events | Locates | Seek and determine the site or place of an object. |
| | Localizes | Roughly determine the location of an object or stimulus (usually in a 360° radius). |
| | Searches | (a) Directed viewing for a specific class of objects. (b) Purposeful exploration or looking for specific item(s). |

Table 3
Verb Taxonomy for Cognitive Behaviors

| Activities | Specific behaviors | Definitions |
|-------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Information processing | Associates | Connect one object or class of objects with another object or class of objects on the basis of heuristics. [<i>Computer</i>] |
| | Interpolates | (a) Determine or estimate intermediate values from two given values. [<i>Computer</i>] (b) Assign an approximate value to an interim point based upon knowledge of values of two or more bracketing reference points. [<i>Computer</i>] |
| | Itemizes | List or specify the various components of a grouping. |
| | Remembers | Retain information (short-term memory) or to recall information (long-term memory) for consideration. |
| | Tabulates | Tally or enumerate the frequencies or values of the members of an itemized list or table. |
| | Translates | Convert or change from one form or representational system to another according to some consistent "mapping" scheme. |
| | Verifies | Confirm or prove the truth of an assumption, condition, or state. |
| | Visualizes | Construct a mental picture of a situation. |
| | Analyzes | (a) Separate material or abstract entity into constituent parts. (b) Synthesize. (c) Examine critically. |
| | Calculates | (a) Determine by mathematical processes. (b) Reckon, mentally compute, or computationally determine. |
| | Chooses | Select after consideration of alternatives. |
| | Compares | (a) Examine the characteristics or qualities of two or more objects or concepts for the purpose of discovering similarities or differences. (b) Consider two or more entities in parallel so as to note relative similarities and differences. |
| | Coordinates | Harmonize in a common effort to settle or arrange. |
| | Decides | Come to a conclusion based on available information. |
| | Determines | Induce or deduce a conclusion or decision. |
| Problem solving and decision making | Diagnoses | Recognize or determine the nature or cause of a condition by consideration of signs and symptoms or by the execution of appropriate tests. |
| | Estimates | (a) Calculate, interpolate, or extrapolate value(s) within some tolerance. (b) Mentally gauge, judge, or approximate, often on the basis of incomplete data. |
| | Organizes | Correlate, order, or prioritize objects (or classes of objects) |
| | Plans | Project or arrange a scheme for accomplishing an activity. |

Table 4
Verb Taxonomy for Motor Behaviors

| Activities | Specific behaviors | Definitions |
|-----------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Simple or discrete | Activates | Perform a control action, causing a device to become active. [<i>Computer</i>] |
| | Attaches | Affix an object to a larger object by tying or gluing. |
| | Closes | (a) Shut an entrance or opening. (b) Terminate a computer program or application. [<i>Computer</i>] |
| | Connects | Bind or fasten two objects together. |
| | Deactivates | Perform a control action, causing a device to become inactive. [<i>Computer</i>] |
| | Disconnects | Detach or unfasten two objects. |
| | Enters | Place a value or text string into a computer by means of an input or control device. [<i>Computer</i>] |
| | Moves | Change the location of an object or person. |
| | Opens | Unfasten affording unobstructed passage. |
| | Presses | Apply a steady weight or force to an object. [<i>usually Computer</i>] |
| | Pushes or pulls | Exert force away from or toward the soldier's body. [<i>usually Computer</i>] |
| | Selects | (a) Choose an object from a set of alternatives. (b) Choose an entity (e.g., a position or an object) by "pointing" to it. [<i>Computer</i>] |
| | Sets | Place an instrument in a specific setting or reading in order to achieve a specific state or mode. |
| | Starts | Begin an activity or movement. |
| | Steers | Guide the course of a vehicle. |
| | Stops | Terminate the movement of a vehicle. |
| Complex or continuous | Adjusts | Operate a continuous control. |
| | Aligns | Arrange objects into a straight line. |
| | Annotates | (a) Enter a text string. [<i>Computer</i>] (b) To note or write down textual material. |
| | Applies | Put into action for a purpose |
| | Dons | Put on clothing, especially mission-oriented protective posture (MOPP). |
| | Installs | Put into an appointed place or position. |
| | Orients | Adjust or transform an object in relation to its centroid. [<i>Computer</i>] |
| | Positions | (a) Operate a control that has discrete states. (b) Indicate a 1-, 2-, or 3-dimensional coordinate. [<i>Computer</i>] |
| | Regulates | Adjust to some standard (e.g., amount, degree, rate). |
| | Removes | Take out of an appointed place or position. |
| | Synchronizes | Cause to operate at the same rate and exactly together. |
| | Tracks | Visually pursue the movement of an object. [<i>usually Computer</i>] |
| | Types | Operate a keyboard. [<i>Computer</i>] |

Table 5
Verb Taxonomy for Communications Behaviors

| Specific behaviors | Definitions |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advises | Give information notifying others of a recommended course of action. [Voice, FM Radio, FM Digital] |
| Answers | Respond to a request for information. [Voice, FM Radio, FM Digital] |
| Communicates | Relay knowledge or information to others. [Voice, FM Radio, FM Digital] |
| Directs | (a) Ask for action. [Voice, FM Radio, FM Digital] (b) Provide explicit authoritative instructions. [Voice, FM Radio, FM Digital] |
| Indicates | Verbally direct the attention of others in a general way. [Voice, FM Radio] |
| Informs | (a) Impart information. [Voice, FM Radio, FM Digital] (b) Pass on or relay new knowledge or data. [Voice, FM Radio, FM Digital] |
| Instructs | Teach, educate, or provide remedial data. [Voice, FM Radio, FM Digital] |
| Requests | Ask for information. [Voice, FM Radio, FM Digital] |
| Receives | (a) Be given written or verbal information. [Voice, FM Radio, FM Digital] (b) Set, obtain, or acquire an incoming message. [Voice, FM Radio, FM Digital] |
| Records | Document something, as in writing. |
| Transmits | Send or forward information to a receiver (human or machine). [Voice, FM Radio, FM Digital] |

Table 6
Verb Taxonomy for Maintenance Tasks

| Maintenance type | Maintenance tasks | Definitions |
|------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preventive maintenance | Performs PMCS | Performing prescribed preventive maintenance, checks, and services in an attempt to retain an item or component in a specified condition by providing systematic inspection, detection, and prevention of incipient failures. |
| Corrective maintenance | Adjusts and repairs | The process of returning an item or component to a specified condition through one or more of the following actions: recalibrate, retune, and fault correction. |
| | Boresights | Align multiple vision devices or vision devices with weapon systems to aim at a point using either a collimator or a distance aiming point. |
| | Inspects | Examining objects critically for deviations or unacceptable conditions. |
| | Removes and replaces | Taking a unit or component from a system and the reverse. |
| | Tests and checks | Determining whether a system is functioning within prescribed limits. |
| | Trouble shoots | Isolating to the line-replaceable unit level the cause of a fault through a systematic, analytical process. |

The object of the action is identified by a combination of entries in the task statement: component, parameter, state, or the result of a cognitive activity. Sufficient information to properly identify the object of the action is desirable. The component is the equipment or device within the system upon which the operator acts or perceives. A parameter is a system or component variable that the operator affects or perceives. The state reflects the condition of the component or parameter upon completion of the task. A result of a cognitive activity may include conclusions regarding decisions made by an operator. This part of speech is always required in task statements prepared for the BFIST demonstrator task list.

Object Modifiers

Object modifiers serve to refine or qualify some aspect of the object of action being described in a task. Three types of object modifiers are in line with the three types of objects of action: component modifiers, parameter modifiers, and state modifiers. For example, a component modifier may be needed to distinguish between similar components within a subsystem. A component modifier is a one- or two-word description of the component's function or location in the system. This part of speech is used at the option of the task analyst.

Subordinate Clauses

A description of the purpose of a task is to clarify the intent of the action described in the task statement. While not always necessary, it can be used to provide greater detail than might otherwise be contained in the task statement. Subordinate clauses (e.g., in order to...) are used to present the purpose of a task. This part-of-speech is also used at the option of the task analyst.

SUMMARY AND CONCLUSION

This report described the objectives, technical approach, and methodology in the development of the BFIST demonstrator task list. The BFIST demonstrator task list serves two purposes. First, it provides the USAFAS with a detailed description of the missions, mission segments, functions, and tasks required for the BFIST operations, maintenance, and direct support. The USAFAS can use the task list as an additional statement of performance requirements for the BFIST development. Second, the task list will serve as a basis for the HARDMAN III analyses of BFIST MANPRINT issues. Figure 2 illustrates the role of HARDMAN III in the BFIST acquisition process.

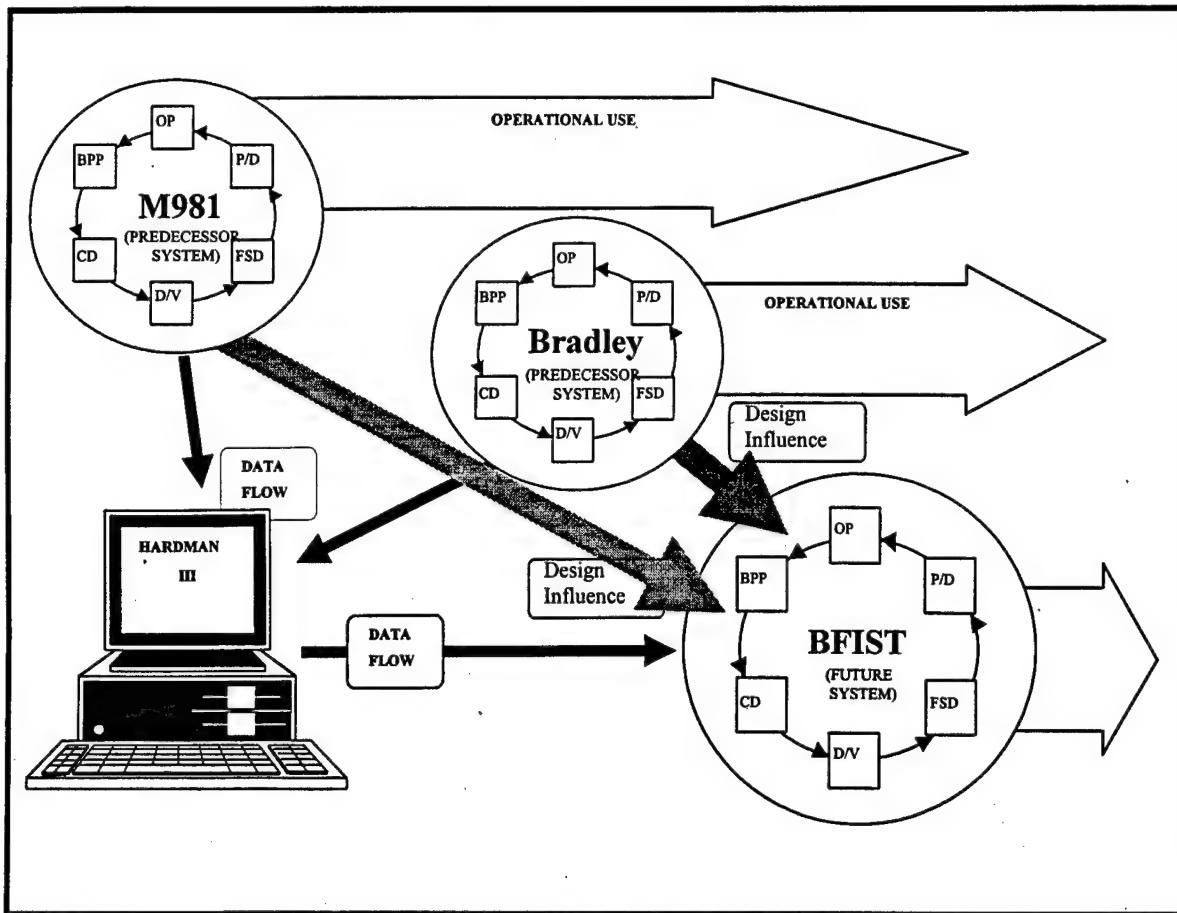


Figure 2. The role of HARDMAN III in BFIST acquisition. (The acronyms arranged in circular fashion in the three circles in the figure are (a) BPP, branch planning process, (b) CD, concept development, (c) D/V, demonstration and validation, (d) FSD, full scale development [also known as engineering and manufacturing], (e) P/D, production and deployment, and (f) OP, operation. These terms represent phases in military acquisition.)

The BFIST demonstrator task list will help address a variety of MANPRINT questions pertaining to the BFIST system. Simulations based on the BFIST demonstrator task list will be designed and executed to provide quantitative predictions of various aspects of the BFIST crew performance. Variables such as crew size, personnel, and training attributes of the BFIST crew will be manipulated to determine the optimum BFIST crew characteristics.

The BFIST demonstrator task list represents a comprehensive technical basis for subsequent MANPRINT analyses. It was developed, based on the best available source documentation and has been extensively reviewed by the USAFAS SMEs for technical accuracy and adequacy. It is understood that the task list contained in this report and analyses based on this task list may be revised as the BFIST matures.

REFERENCES

Berliner, C., Angel, D., & Shearer, J. (1964). Behaviors, measures, and instruments for performance evaluation in simulated environments. In Symposium and Workshop on the Qualification of Human Performance. Albuquerque, NM.

Lowry, J., & Wilkinson, T. (1993). Advanced field artillery system (AFAS) task list (Technical report in progress). Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.

BIBLIOGRAPHY

Department of the Army (undated). Radio sets (SINCGARS-V) (Field Manual 24-24). Washington, DC: Author.

Department of the Army (1985). Operator's manual, carrier, personnel, full tracked, armored fire support, M981 (TM 9-2350-226-10). Washington, DC: Author.

Department of the Army (1985). Fire support handbook (FC 6-20-20). Fort Sill, OK: Author.

Department of the Army (1986). The mechanized infantry platoon and squad (Bradley) (FM 7-7J). Washington, DC: Author.

Department of the Army (1986). Operator's manual, fighting vehicle, infantry, hull (TM 9-2350-252-10-1). Washington, DC: Author.

Department of the Army (1986). Operator's manual, fighting vehicle, infantry, turret (TM 9-2350-252-10-2). Washington, DC: Author.

Department of the Army (1987). Targeting station operations for the M981 FSV. Fort Sill, OK: Author.

Department of the Army (1988). Fire support in the airland battle. (FM 6-20). Washington, DC: Author.

Department of the Army (1990). Mission training plan for the field artillery cannon battalion fire support (ARTEP 6-115-20-MTP). Washington, DC: Author.

Department of the Army (1990). The field artillery cannon battalion (FM 6-20-1). Washington, DC: Author.

Department of the Army (1990). Fire support for brigade operations (heavy) (FM 6-20-40). Washington, DC: Author.

Department of the Army (1990). Fire support for brigade operations (light) (FM 6-20-50). Washington, DC: Author.

Department of the Army (1990). Soldier's manual of common tasks, skill level 1 (STP21-1 SMCT). Washington, DC: Author.

Department of the Army (1991). The field artillery cannon battery (Field Manual 6-50). Washington, DC: Author.

Department of the Army (1991). Observed fire (FM 6-30). Washington, DC: Author.

Department of the Army (1991). Fire support specialist, MOS 13F (STP 6-13F14-SM-TG). Washington, DC: Author.

Department of the Army (1994). Operational requirements document (ORD) for the Bradley fire support vehicle (BFIST). Fort Monroe, VA: TRADOC HQ.

Depth and Simultaneous Attack Battle Lab (1993). Bradley fire support vehicle, 1 Sep -10 Dec on-site test and demonstration. Fort Sill, OK: Author.

Depth and Simultaneous Attack Battle Lab (1994). Bradley fire support vehicle concept evaluation report. Fort Sill, OK: Author.

APPENDIX A
BFIST DEMONSTRATOR TASK LIST

BFIST DEMONSTRATOR TASK LIST

A. OPERATE SYSTEM

1. Receive FRAGO

Alert crew

- Receives warning of upcoming operation
- Determines content of directions to crew
- Instructs crew to start preparations for combat

Move to company headquarters (HQ) to receive planning guidance

- Selects fire planning or observing materials
- Moves to company HQ

2. Prepare for operations

Operate turret shield door

- Opens turret shield door
- Inspects turret shield warning light
- Moves into turret
- Closes turret shield door

Start BFIST engine

- Adjusts driver's controls, seat, lap belt, and combat vehicle crewmember (CVC) helmet
- Tests and checks driver's panel gauges and switches
- Activates (starts) engine
- Monitors driver's instrument panel gauges

Prepare the targeting system

- Installs the laser designator and rangefinder (LD/R)
- Installs the thermal night sight

Conduct the north seeking gyrocompass (NSG) confidence check

- Verifies correct vehicle coordinates are in memory
- Presses and releases NSG alignment and enter keys
- Monitors display until realignment is complete
- Presses and releases heading key

Tests and checks targeting station control display (TSCD) display with known direction

Conduct the targeting systems accuracy check

- Calculates target position
- Compares calculated position with known coordinates

Check boresight of LD/R

- Installs boresight collimator
- Inspects boresight of LD/R
- Boresights LD/R

Conduct targeting systems nightsight check and boresight alignment

- Activates nightsight
- Inspects boresight alignment of targeting system's nightsight
- Adjusts boresight alignment of targeting system's nightsight
- Removes boresight collimator

Conduct the turret systems operational check-out

- Activates the turret power switch
- Tests and checks turret traverse (slow)
- Tests and checks turret slew (fast)
- Tests and checks handgrip triggers
- Tests and checks fire interrupt circuitry and audible alarm
- Tests and checks deck clearance system
- Tests and checks turret stabilization system

Initialize the forward-looking infrared (FLIR)

- Activates the FLIR
- Inspects the FLIR sight picture

Initialize the precision lightweight global positioning system (GPS) receiver (PLGR)

- Activates the PLGR
- Tests and checks the PLGR system with built-in test equipment (BITE)

Initialize the battlefield intelligence system (BIS)

- Activates the BIS
- Tests and checks the BIS with BITE

Check and boresight the 25mm gun

- Inspects 25mm gun system for dirt or damage
- Positions and aligns (prepares) 25mm gun for boresighting
- Installs boresight adaptor and telescope for 25mm gun
- Adjusts and aligns (boresights) 25mm gun sight
- Tests and checks boresight for 25mm gun

Check and boresight the coax machine gun

- Inspects coax machine gun for dirt and damage
- Positions and aligns (prepares) coax machine gun for boresighting
- Installs boresight adaptor and telescope on machine gun (2 man)
- Adjusts and aligns (boresights) coax machine gun

Check and boresight integrated sighting unit (ISU) for turret weapons
Inspects ISU controls, lights, and sight displays for weapons
Adjusts and aligns (boresights) weapons nightsight to daysight
Tests and checks nightsight and daysight boresight for weapons

Conduct FIST digital message device (DMD) diagnostics checks
Tests and checks display and indicator lamps
Tests and checks keyboard (keyboard test)
Tests and checks communications interface
Tests and checks message bell volumes

Conduct FIST DMD initial status selection
Enters communications parameters
Enters FIST DMD functional characteristics

Activate communications
Receives frequencies and call signs from signal operation instructions
Enters authentication codes and operator's key in FIST DMD
Tests and checks intercommunications set

Enter radio nets
Enters field artillery (FA) battalion fire direction net
Enters maneuver battalion mortar fire direction net
Enters battalion fire support element (FSE) net
Enters maneuver company command net
Activates digital communications on fire nets
Monitors radio communications

Prepare radio for off-vehicle operations
Removes radio from its mount in BFIST
Installs battery box, harness, antenna, and handset to radio
Determines frequency from signal operation instructions
Sets frequency on radio
Enters FA fire direction net

Prepare forward entry device (FED) for off-vehicle operations
Removes FED from stowage in BFIST
Installs battery for the FED
Connects FED to radio for off-vehicle operations
Tests and checks (operational tests) the FED
Enters FED initialization data

Perform before PMCS on the BFIST hull
 Inspects BFIST suspension
 Inspects external fire suppression handles
 Inspects final drive hull drain plugs
 Inspects drivers hatch
 Inspects hull drain plugs
 Inspects hand brake
 Inspects internal fire extinguishers
 Inspects fire suppression switch and handles

Prepare eye-safe, hand-held laser rangefinder (LR) for operation
 Performs before-operation PMCS on the LR
 Installs the battery for the LR
 Inspects the battery for the LR
 Connects the LR to an external power source

Determine direction using an M-2 compass and map
 Calculates declination constant
 Sets declination constant on compass
 Determines direction using compass

3. Prepare for movement

Perform during PMCS on the BFIST turret
 Tests and checks turret indicator lights
 Tests and checks gun fans
 Tests and checks turret drive system
 Tests and checks turret slew and elevation or depression

Perform during PMCS on BFIST weapons
 Inspects 25mm gun from observation station by dry firing
 Inspects coax machine gun from observation station by dry firing
 Inspects 25mm gun from targeting station by dry firing
 Inspects coax machine gun from targeting station by dry firing
 Tests and checks smoke grenade system launcher

Perform during PMCS on the BFIST driver's station
 Monitors driver's instrument panel gages and lights
 Inspects driver's controls
 Inspects driver's periscope
 Inspects driver's compartment nuclear, biological, and chemical (NBC) system
 Inspects personnel heater

Perform during PMCS on other BFIST systems
 Tests and checks vehicle NBC system
 Inspects hatches and doors
 Inspects storage of high explosive (HE) and armor piercing (AP) ammunition for 25mm gun

Load turret weapons

- Installs (loads) ammunition in the 25mm gun feeder
- Installs (loads) HE ammunition in the 25mm gun
- Installs (loads) AP ammunition in the 25mm gun
- Installs (loads) coax machine gun

Test fire turret weapons

- Moves turret drive system to OFF
- Removes 25mm gun guard and gun cover
- Moves manual SAFE handle to FIRE position
- Closes gun cover and installs 25mm gun guard
- Selects ammunition type (HE or AP)
- Moves turret drive system to ON
- Moves sight on target
- Presses trigger
- Selects machine gun
- Presses trigger

4. Drive or navigate the BFIST

Prepare to drive

- Receives order to prepare to move
- Presses (sounds) horn
- Closes (raises) ramp

Drive the BFIST

- Adjusts or moves BFIST driver's controls
- Moves and steers BFIST

Navigate vehicle by terrain association

- Plans route visualizing a straight line from start point to destination
- Plans route to accommodate weather, terrain and situation
- Directs driver along route
- Steers in response to directions

Navigate vehicle by dead reckoning

- Determines azimuth to distant steering point
- Directs driver to steering point
- Moves to steering point

Operate BFIST on roads

- Regulates speed
- Steers BFIST
- Scans roadway for hazards or approaching traffic
- Adjusts speed and direction of travel

Operate BFIST cross-country unimpeded

Regulates speed

Steers BFIST

Scans ahead for hazards or obstacles

Scans ahead for best route

Adjusts speed and direction

Drive BFIST over trenches

Regulates (decreases) speed approaching trench

Decides trench is negotiable

Steers BFIST perpendicularly over trench

Regulates (increases) speed after crossing trench

Drive BFIST over obstacles

Regulates (decreases) speed approaching obstacle

Decides obstacle is negotiable

Steers BFIST straight on over obstacle

Drive BFIST on side slopes

Regulates (decreases) speed approaching slope

Decides slope is negotiable

Steers BFIST straight up slope

Regulates (decreases) speed at top of slope

Steers BFIST straight down slope

Regulates (increases) speed just before bottom of slope

Drive BFIST on snow, ice, or mud

Regulates speed for conditions

Steers BFIST with gradual corrections

Removes track shoe pads (if necessary)

Prepare to ford water obstacles

Closes open hull drain plugs

Inspects seating of other drain plugs

Inspects operation of bilge pump

Activates bilge pumps

Ford water obstacle

Chooses water obstacle entry or exit points

Steers through (forwards) water obstacle

Performs post-fording PMCS

Prepare to swim water obstacles

- Opens BFIST hatches
- Closes open hull drain plugs
- Inspects seating of other drain plugs
- Removes upper hull drain plugs
- Inspects ramp and door for good seal
- Opens (raises) exhaust shroud
- Installs (erects) water barrier
- Activates bilge pumps

Swim water obstacle

- Chooses water obstacle entry or exit points
- Steers through (swims) water obstacle
- Removes (lowers) water barrier
- Performs post-swimming PMCS

5. Conduct recovery operations

Start BFIST with a slave cable

- Decides to start vehicle with a slave cable
- Requests assistance to start BFIST
- Deactivates (turns off) electrical switches
- Connects slave cable through driver's hatch
- Activates (starts) vehicle

Start vehicle with a combat tow

- Decides to start vehicle with a combat tow
- Directs combat tow to start BFIST
- Requests assistance to tow-start BFIST
- Attaches disabled BFIST to tow vehicle
- Positions transmission range selector to TOW and TOW START
- Positions selector to DRIVE when vehicle starts
- Removes cables or tow bar

Tow BFIST to a safe location

- Decides to tow BFIST to a safe location
- Directs combat tow to safe location
- Requests a combat tow from a second vehicle
- Connects BFIST to tow vehicle
- Monitors BFIST movement throughout combat tow
- Disconnects BFIST from tow vehicle

Recover BFIST bellied in mire

- Decides to recover BFIST bellied in mire
- Directs recovery of vehicle bellied in mire
- Attaches log to BFIST tracks using tow cables
- Moves BFIST forward slowly
- Stops BFIST
- Removes tow cables

Recover BFIST bellied on rocks or stumps

- Decides to recover BFIST bellied on rocks or stumps
- Directs recovery of BFIST bellied on rocks or stumps
- Attaches tow cables to BFIST tracks
- Moves BFIST forward slowly
- Stops BFIST
- Removes cables

Prepare BFIST for abandonment

- Decides to abandon BFIST
- Directs abandonment of BFIST
- Deactivates machine gun and 25mm cannon
- Removes radios, ammunition, and digital devices from BFIST
- Moves away from the BFIST

6. Direct a deliberate position occupation

Select and occupy an observation post

- Chooses an observation post location by map reconnaissance
- Verifies choice with a physical reconnaissance
- Chooses a route to and from the observation post
- Moves BFIST into selected position

Select and occupy a position prepared by engineers

- Chooses an observation post location by map reconnaissance
- Verifies choice with a physical reconnaissance
- Inspects ground-level observation
- Chooses a specific location for BFIST emplacement
- Selects (marks) specific location for preparation by engineers

Determine location using on-board navigation aids

- Reads position coordinates and azimuth from PLGR
- Enters position coordinates and azimuth in TSCD
- Enters an observer location message in FIST DMD
- Transmits location of observation post to fire direction center (FDC) and FSE

Determine self-location using known point(s) or burst(s)
Chooses known point(s) or location of burst(s)
Enter known point(s) or burst(s) in FIST DMD
Aligns ground/vehicular laser locator designator (G/VLLD) with known point(s) or burst(s)
Presses trigger to lase known point(s) or burst(s)
Calculates position using FIST DMD

Re-align the NSG

Verifies correct vehicle coordinates are in memory
Presses and releases the NSG alignment and enter keys
Monitors display until re-alignment is complete

Re-initialize the NSG

Verifies correct vehicle coordinates are in memory
Presses and releases the NSG alignment twice
Observes NSG re-initialize display on TSCD
Presses and releases enter key
Monitors display until re-initialization is complete

Employ the auxiliary generator

Sets up generator for operation
Activates (starts) the auxiliary generator
Adjusts meters and gages to proper readings
Activates (applies) electrical load to generator
Monitors activated generator

Develop observed fire aids

Orients map to terrain
Orients observed fire fan
Analyzes terrain to the front
Translates image of terrain into a terrain sketch
Translates image of terrain into a visibility diagram

Determine cloud height using the G/VLLD

Moves (elevates) G/VLLD to 350 mils toward target area
Presses trigger to lase the cloud formation
Reads range to cloud formation
Calculates cloud height from tables
Transmits cloud height to the FDC

Select the locations for dismounted emplacement of G/VLLD

Determines location for BFIST without G/VLLD
Determines location for a dismounted G/VLLD
Moves BFIST to selected location

Dismount G/VLLD and prepare it for backpacking

- Removes LD/R from turret
- Removes LD/R backpack from its stowage position in BFIST
- Installs LD/R in its backpack
- Removes ancillary equipment transit assembly from stowage
- Removes tripod and traversing unit from stowage location

Dismount radio and prepare it for backpacking

- Removes radio from its mount in BFIST
- Installs battery box, harness, antenna, and handset to radio
- Determines frequency from signal operation instructions
- Sets frequency on radio
- Enters Field Artillery fire direction net

Dismount FED and prepare it for backpacking

- Removes FED from stowage in BFIST
- Installs battery for the FED
- Connects FED to radio for off-vehicle operations
- Tests and checks (operational tests) the FED
- Enters FED initialization data

Dismount nightsight and prepare it for carrying

- Removes nightsight field handling case from stowage location
- Removes nightsight from turret
- Installs nightsight in its field handling case
- Removes battery box, battery power conditioner and collimator

Manpack G/VLLD, FED, radio, and nightsight to new location

- Moves LD/R and ancillary equipment to new location
- Moves radio and FED to new location
- Moves nightsight and ancillary equipment

Emplace G/VLLD and support equipment in dismounted configuration

- Sets traversing unit in designated location
- Installs LD/R on traversing unit
- Attaches interface connector of traversing unit to LD/R
- Installs nightsight interface mount on tripod (night only)
- Installs nightsight on interface mount (night only)
- Installs battery on LD/R

Perform initial check-out of the G/VLLD

- Performs initial PMCS on G/VLLD
- Perform LD/R self tests

Check boresight of LD/R

- Positions LD/R on the target
- Inspects boresight

Conduct nightsight check and boresight alignment

- Adjusts sight for best focus
- Installs collimator on nightsight
- Inspects boresight alignment of nightsight
- Adjusts boresight alignment of nightsight
- Removes collimator on nightsight

Conduct initial orientation of G/VLLD

- Chooses a prominent point whose location is known
- Reads azimuth to a prominent point on the M2 compass
- Orients G/VLLD on same point
- Sets azimuth from M2 compass on G/VLLD
- Determines location through resection and terrain analysis
- Enters position location in FED

Determine self-location using known point(s) or burst(s)

- Chooses known point(s) or location of burst(s)
- Enters known point(s) or burst(s) in FED
- Aligns G/VLLD with known point(s) or burst(s)
- Presses trigger to lase known point(s) or burst(s)
- Calculates position using FED

Establish wire communications

- Directs establishment of wire communications
- Installs (lays) field wire from G/VLLD to BFIST
- Installs (lays) field wire from BFIST to company HQ
- Installs (lays) field wire from BFIST to forward observers (mechanized battalion)
- Receives wire laid by maneuver battalion FSE
- Installs switchboard in BFIST

Erect off-vehicle antennas

- Directs the installation of off-vehicle antennas
- Installs antenna group
- Installs line antenna

Improve position defenses

- Directs improvement of position defenses
- Directs installation of camouflage and cover
- Removes camouflage screen and supports from BFIST
- Installs (erects) camouflage screen
- Selects individual defense positions
- Installs (prepares) individual defense positions
- Monitors position defense improvements
- Informs local ground commander of position location

Select an alternate position location

 Selects alternate position location

 Chooses a route to the alternate position

 Determines coordinates of the alternate position

 Determines direction to a target from the alternate position

Engage enemy with 25mm gun

 Moves turret drive system to OFF

 Removes 25mm gun guard and gun cover

 Moves manual safe handle to FIRE position

 Closes gun cover and installs 25mm gun guard

 Selects HE or AP ammunition

 Moves turret drive system to ON

 Activates nightsight (night only)

 Searches for or locates target

 Decides to engage target

 Presses trigger

Engage enemy with coax machine gun

 Activates nightsight (night only)

 Searches for or locates target

 Decides to engage target

 Presses trigger

7. Move from a prepared position

Remove camouflage

 Decides to remove camouflage

 Directs camouflage be removed

 Removes camouflage

Strike off-vehicle antennas

 Decides to strike off-vehicle antennas

 Directs off vehicle antennas be struck

 Deactivates (strikes) line antenna

 Deactivates (strikes) antenna group

 Installs (stows) antennas in BFIST

Disestablish wire communications

 Decides to disestablish wire communications

 Directs disestablishment of wire communications

 Disconnects field wire

 Installs field wire on reel

 Installs switchboard in BFIST stowage location

Direct G/VLLD be returned to BFIST and installed in turret

Decides to return the G/VLLD to the BFIST

Directs G/VLLD be returned to the in BFIST

Disassemble G/VLLD for manpacking

Disconnects LD/R battery

Disconnects nightsight from interface mount

Disconnects interface mount from tripod

Installs battery, interface mount, and nightsight in cases

Disconnects LD/R from traversing unit

Installs LD/R, tripod, and traversing unit in backpacking configuration

Manpack G/VLLD, FED, radio, and nightsight to BFIST location

Moves LD/R and ancillary equipment to BFIST location

Moves radio and FED to BFIST location

Moves nightsight and ancillary equipment

Return G/VLLD to BFIST

Installs tripod and traversing unit in BFIST stowage location

Installs ancillary equipment transit assembly to stowage

Removes LD/R from its backpack

Installs LD/R in turret

Installs LD/R backpack in BFIST stowage location

Return radio and FED to BFIST

Disconnects FED from radio

Removes battery from the FED

Installs FED in BFIST stowage location

Removes radio battery box, harness, antenna, and handset

Installs battery box, harness, antenna, and handset

Installs radio in its mount in BFIST

Return nightsight to BFIST

Removes nightsight from its field handling case

Installs nightsight in the BFIST turret

Installs nightsight field handling case in BFIST stowage

Installs battery case, power conditioner, and collimator

Move to alternate position

Decides to move to alternate position

Directs movement to alternate position

Moves BFIST to alternate position location

Enters pre-determined position coordinates and azimuth in TSCD

Enters observer location message on FIST DMD

Transmits message to FDC and battalion fire support officer (FSO)

8. Perform a hasty occupation

Select and occupy a position for a hasty occupation

Decides to conduct a hasty occupation

Chooses a hasty occupation location by map reconnaissance

Selects an observation post

Moves BFIST to selected location

Determine location using on-board navigation aids

Reads position coordinates and azimuth from PLGR

Enters position coordinates and azimuth in TSCD

Enters an observer location message in FIST DMD

Transmits location of observation post to FDC and battalion FSO

Conduct initial orientation of G/VLLD

Chooses a prominent point whose location is known

Reads azimuth to a prominent point on the M2 compass

Orients G/VLLD on same point

Sets azimuth from M2 compass on G/VLLD

Determines location through resection and terrain analysis

Enters position location in TSCD

Continue forward movement (bound forward)

Decides to move forward in support of ground operation

Directs preparations for movement

Determines route from position

Directs movement along chosen route

Steers (drives) along chosen route

B. CONDUCT FIRE SUPPORT

1. Receive planning guidance

Receive battalion order

Moves from BFIST to company HQ

Moves to battalion tactical operations center (TOC) with company commander

Receives battalion order with company commander

Receives battalion fire support plan and guidance from battalion FSO

Moves to company HQ with company commander

Receive planning direction and guidance from company commander

Receives mission and scheme of maneuver

Receives enemy information and likely avenues of approach

Receives ground control measures

Receives priorities for fires supporting platoons

Receives guidance for planning and scheduling fires

2. Advise company commander

Determine elements of advice to company commander

- Determines the availability of fire support means
- Analyzes friendly weapons capabilities
- Determines optimum employment of friendly fires
- Determines availability of target acquisition assets
- Determines optimum employment of target acquisition assets
- Analyzes enemy fire support capabilities

Advise company commander

- Advises company commander on availability of fire support means
- Advises company commander on friendly weapons capabilities
- Advises company commander on the employment of friendly fires
- Advises company commander on target acquisition asset availability
- Advises company commander on target acquisition asset employment
- Advises company commander on enemy fire support capabilities

3. Plan fire support

Develop a fire support plan

- Moves from company HQ to BFIST
- Receives targets from observers
- Itemizes (consolidates) targets from observers
- Decides (resolves) targeting conflicts
- Plans fire coordination measures
- Organizes targets on target list
- Plans (develops) a fire support plan

Plan fires to support a movement to contact

- Plans fires from line of departure or contact to the objective
- Plans fires on top of the objective
- Plans fires beyond the objective
- Plans fires to the flanks

Plan fires to support a deliberate attack

- Plans fires from line of departure or contact to the objective
- Plans fires on top of the objective
- Plans smoke to isolate the objective
- Plans fires beyond the objective
- Plans fires to deceive the enemy
- Plans fires to the flanks

Plan fires to support a defensive operation

- Plans fires deep on battlefield
- Plans fires covering likely avenues of approach
- Plans final protective fires
- Plans fires for possible retrograde

Plan fires to support maneuver reconnaissance

- Plans fires from line of departure or contact to the objective
- Plans fires on top of the objective
- Plans fires beyond the objective
- Plans fires to the flanks

Plan fires to support maneuver security operations

- Plans fires to impede, destroy, and harass
- Plans fires to cause enemy to consolidate forces
- Plans fires to cause enemy to reveal main thrust
- Plans fires to cause enemy to slow his advance.

4. Coordinate, brief, and rehearse fire plan

Obtain approval for fire support plan

- Receives approval for fire plan from battalion FSO
- Moves from BFIST to company HQ
- Advises (briefs) company commander on fire plan
- Answers questions from company commander on fire plan
- Records changes directed by company commander or battalion FSO

Participate in company commander's order and battalion rehearsal

- Listens to company commander's operation order
- Communicates (presents) company fire plan
- Answers questions from platoon leaders and forward observers
- Moves to Battalion HQ with company commander
- Observes and participates in battalion rehearsal
- Moves to company HQ with company commander
- Receives last minute guidance and changes
- Moves to BFIST
- Advises (briefs) crew on upcoming operation
- Enters targets in FIST DMD

5. Perform quick (hasty) fire planning

Determine requirements for hasty fire planning

- Receives warning of short-notice tactical maneuver
- Moves from BFIST to company headquarters
- Listens to company commander's guidance
- Requests clarifying information
- Determines fire support requirements
- Advises company commander on available fire support

Conduct hasty fire planning

- Informs FDC of the situation and fire support needs
- Requests establishment of quick fire net
- Receives targets from platoon observers
- Plans (develops) a quick fire plan

Plan fires to support a hasty attack

- Plans fires from line of departure or contact to the objective
- Plans fires on top of the objective
- Plans smoke to isolate the objective
- Plans fires beyond the objective
- Plans fires to the flanks

Plan fires to support an exploitation

- Plans fires from line of departure or contact to the objective
- Plans fires on top of the objective
- Plans fires beyond the objective
- Plans fires to the flanks

Plan fires to support a pursuit

- Plans fires from line of departure or contact to the objective
- Plans fires on top of the objective
- Plans fires beyond the objective
- Plans fires to the flanks

Brief and refines fire plan

- Advises (briefs) company commander on fire plan
- Answers company commander's questions on fire plan
- Records changes on fire plan directed by company commander
- Coordinates fire plan with battalion FSO
- Transmits fire plan to FDC for execution

Respond to company commander's operations order

- Listens to company commander's operations order
- Answers questions from platoon leaders and forward observers on fire plan
- Moves from company headquarters to BFIST
- Enters targets in FIST DMD's FIREPLAN message
- Annotates maps and situational charts

6. Control and coordinate fires

- Receives requests from observers for on-call targets
- Analyzes targets for engagement
- Determines priorities for calls for fire
- Requests alternate fire support means
- Requests immediate suppression, suppression of enemy air defenses (SEAD), and final protective fire (FPF)
 - Identifies requirement to update fire plans
 - Determines changes required to update fire plans
 - Records and transmits changes to fire plans
 - Requests alternate means of fire support from battalion FSE
 - Receives size, activity, location, unit, time, and equipment (SALUTE) Reports
 - Transmits SALUTE Reports

C. ENGAGE TARGETS

1. Direct field artillery fires

Conduct an impact and time registration

- Chooses a registration point
- Determines the call for fire
- Transmits the call for fire
- Transmits range and deviation corrections
- Transmits HE refinement data
- Observes one airburst
- Transmits correction to adjust height of burst

Conduct a highburst registration

- Orients the G/VLLD for direction and vertical angle
- Communicates when ready to observe
- Presses trigger to lase the burst
- Communicates data for each round

Conduct an adjust fire (manual) or fire for effect (FFE) mission

- Locates target
- Transmits the call for fire
- Determines and transmits range and deviation corrections
- Determines and transmits refinement data
- Determines and transmits observed effects

Conduct a coordinated illumination mission

- Locates target
- Determines and transmits call for fire
- Determines and transmits illumination corrections
- Determines and transmits the HE call for fire
- Transmits range and deviation corrections
- Determines and transmits refinement data
- Determines and transmits observed effects

Conduct a moving target engagement

- Estimates the enemy's speed and direction of movement
- Determines a trigger point
- Determines an intercept point
- Tracks enemy movement
- Requests fires to engage enemy as he crosses intercept point
- Determines and transmits observed effects

Conduct a suppression mission

- Transmits on-call target number and call for fire
- Determines and transmits observed effects

Conduct an immediate suppression mission

- Locates the target
- Determines and transmits the call for fire
- Determines and transmits refinement data
- Determines and transmits observed effects

Adjust final protective fires

- Selects an adjusting point
- Receives approval for adjusting point from company commander
- Determines and transmits the call for fire
- Determines and transmits observer-target direction
- Directs (calls for) each round singly
- Determines and transmits single round adjustments

Call for final protective fires

- Receives call from company commander to fire FPF
- Directs (calls for) final protective fires
- Determines and transmits observed effects

2. Direct other supporting fires

Direct a mortar mission

- Determines and transmits a call for fire
- Locates (spots) impact of rounds
- Transmits a battle damage assessment
- Determines and transmits refinement data

Conduct a mortar registration

- Determines and transmits a call for fire
- Locates (spots) impact of rounds
- Determines and transmits range and deviation corrections
- Determines and transmits sheaf adjustments

Direct a close air support mission

- Locates target for engagement
- Identifies friendly locations
- Estimates enemy air defense artillery threat
- Transmits a SEAD request
- Transmits target identification
- Requests clearance from battalion FSE
- Activates (establishes) communication with aircraft
- Requests aircraft line-up information
- Selects (marks) the target orally or with G/VLLD
- Determines and transmits observed effects

Direct a naval gunfire mission

- Determines target location
- Transmits call for fire
- Determines and transmits refinement data
- Determines and transmits observed effects

Direct an attack helicopter strike

- Locates target for engagement
- Identifies friendly locations
- Estimates enemy air defense artillery threat
- Transmits a SEAD request
- Indicates type of target
- Activates (establishes) communication with aircraft
- Tracks target with G/VLLD
- Selects (marks) the target orally or with G/VLLD
- Determines and transmits observed effects

3. Conduct copperhead missions

Prepare for a planned copperhead mission

- Analyzes terrain for planned target locations
- Estimates planned target intercept point
- Requests firing battery location from FDC
- Determines correct footprint template from table
- Selects correct template card from template packet
- Orients template card on map
- Annotates (draws) footprint on map
- Determines plausibility of mission from footprint and angle T
- Enters planned target in FIST DMD
- Receives planned target number from FDC

Conduct a planned copperhead mission

- Searches for an approaching target for copperhead
- Identifies an approaching target
- Decides to engage target with copperhead
- Transmits request for fire on a planned target
- Informs FDC to fire on target upon command
- Aligns G/VLLD with target
- Directs FDC to fire copperhead
- Presses trigger to lase targets when directed by FDC
- Determines and transmits observed effects

Engage target of opportunity for copperhead

- Searches for an approaching target for copperhead
- Identifies an approaching target
- Decides to engage the target
- Estimates target will be visible throughout engagement
- Determines intercept point
- Determines plausibility of mission based on angle T
- Transmits call for fire to FDC
- Informs FDC to fire on target upon command
- Tracks target with G/VLLD
- Directs FDC to fire copperhead
- Presses trigger to lase targets
- Determines and transmits observed effects

Engage multiple targets of opportunity for copperhead

- Searches for approaching targets for copperhead
- Identifies multiple targets
- Decides to engage the multiple targets
- Transmits call for fire to FDC
- Informs FDC to fire first round on command
- Informs FDC to fire subsequent rounds at specified intervals
- Tracks target with G/VLLD
- Directs FDC to fire copperhead
- Presses trigger to lase targets
- Determines and transmits observed effects

D. ENSURE SURVIVABILITY

1. Conduct smoke operations

Operate BFIST smoke grenade launchers

- Decides to fire smoke grenade launchers
- Activates smoke grenade ARM switch
- Pushes switch to fire the smoke grenade launchers
- Sets the smoke grenade launchers by reloading

Operate the BFIST smoke screen generator

Decides to activate the BFIST smoke screen generator

Activates the smoke screen generator

Deactivates the smoke screen generator

Conduct an immediate smoke mission

Determines placement point for smoke

Transmits call for fire

Determines and transmits corrections

Conduct a quick smoke mission

Determines size of area to be obscured

Determines the wind direction

Determine maneuver-target line

Determines HE adjusting point

Determine duration of smoke

Transmits call for fire

Determines and transmits adjustment of HE rounds

Directs (calls for) engagement with smoke

2. Conduct NBC defensive operations

Respond to an NBC alert

Receives an NBC alert

Verifies alert

Decides to install warning devices

Removes M-8 alarm from BFIST

Installs M-8 alarm outside of BFIST

Installs detector paper on personnel and equipment

Moves perishables inside vehicle

Closes ramp and hatches

Implement mission-oriented protective posture (MOPP) posture

Receives MOPP conditions

Dons MOPP equipment and overgarments

Closes all hatches

Respond to an NBC alarm

Dons the tank mask

Dons the protective mask

Determines and transmits NBC report

Implement decontamination procedures

Determines contamination status

Inspects personnel

Inspects equipment

Respond to a survivability move order

- Monitors radio for a survivability move order
- Directs move
- Starts BFIST
- Moves BFIST
- Steers BFIST to safe location

3. Treat and evacuate injured

- Applies first aid
- Determines medical requirements
- Determines evacuation requirements
- Moves casualty for evacuation

4. Perform after PMCS

- Performs after PMCS on BFIST hull
- Inspects fuel gauges for low fuel levels
- Inspects NBC system for water contamination
- Inspects engine compartment hoses and clamps and oil level
- Inspects intake screen for debris or damage
- Inspects transmission oil level
- Inspects cooling system for leaks
- Inspects fuel system and drain for contaminants
- Inspects fuel system hoses, valves, and fittings for leaks
- Inspects hydraulic power unit for fuel level and leaks
- Inspects final drive for looseness or missing fasteners
- Inspects suspension for overheating hubs and track condition
- Adjusts and repairs where authorized

Perform after PMCS on the smoke grenade launcher

- Removes unspent grenades from smoke grenade launcher
- Performs after PMCS on grenade launcher
- Installs rubber caps on grenade launcher tubes

Perform after PMCS on 25mm gun

- Removes 25mm gun from BFIST
- Inspects 25mm gun
- Performs after PMCS on 25mm gun
- Installs 25mm gun in BFIST

Perform after PMCS on coax machine gun

- Removes coax machine gun from BFIST
- Inspects coax machine gun
- Performs after PMCS on the coax machine gun
- Installs coax machine gun in BFIST

Perform after PMCS on auxiliary generator

 Inspects generator for fuel leaks

 Inspects generator for loose wires and attachments

 Inspects fuel and oil levels

 Adjust and repair generator where authorized

Report uncorrected during operation discrepancies

 Records and transmits during operation discrepancies on turret

 Records and transmits during operation discrepancies on communication equipment

 Records and transmits during operation discrepancies on digital equipment

 Records and transmits during operation discrepancies on targeting system

APPENDIX B
ACRONYMS AND ABBREVIATION LIST

ACRONYMS AND ABBREVIATION LIST

| | |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AP | armor piercing |
| BFIST | Bradley fire support vehicle |
| BIS | battlefield intelligence system |
| BITE | built-in test equipment |
| COLT | combat observation lasing team |
| CVC | combat vehicle crew member |
| DMD | digital message device |
| FA | field artillery |
| FDC | fire direction center |
| FED | forward entry device |
| FFE | fire for effect |
| FIST | fire support team |
| FISTV | fire support team vehicle |
| FLIR | forward-looking infrared |
| FPF | final protective fire |
| FRAGO | fragmentary order |
| FSE | fire support element |
| FSO | fire support officer |
| G/VLLD | ground/vehicular laser locator designator |
| GPS | global positioning system |
| HARDMAN III | hardware versus manpower - Version III. (A suite of interrelated computer modeling tools used to analyze the impact of change on manpower, personnel, and training, and on military system performance due to the interaction of human operators and equipment.) |
| HE | high explosive |
| HQ | headquarters |
| ISU | integrated sight unit |
| LD/R | laser designator/range finder |
| LR | Laser range finder |
| MANPRINT | manpower and personnel integration |
| MOPP | mission-oriented protective posture |
| NBC | nuclear, biological, and chemical |
| NSG | north-seeking gyrocompass |
| PLGR | precision GPS receiver |
| PMCS | preventive maintenance checks and services |

| | |
|--------|-----------------------------------------------------|
| SALUTE | size, activity, location, unit, time, and equipment |
| SEAD | suppression of enemy air defenses |
| SME | subject matter expert |
| TSCD | targeting station control display |
| TOC | tactical operations center |
| USAFAS | United States Army Field Artillery School |

| <u>NO. OF COPIES</u> | <u>ORGANIZATION</u> | <u>NO. OF COPIES</u> | <u>ORGANIZATION</u> |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 2 | ADMINISTRATOR DEFENSE TECHNICAL INFO CENTER ATTN DTIC DDA 8725 JOHN J KINGMAN RD STE 0944 FT BELVOIR VA 22060-6218 | 1 | COMMANDANT USA ARTILLERY & MISSILE SCHOOL ATTN USAAMS TECH LIBRARY FORT SILL OK 73503 |
| 1 | DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL OP SD TA/ REC MGMT 2800 POWDER MILL ROAD ADELPHI MD 20783-1197 | 1 | COMMANDER USA TANK-AUTOMOTIVE R&D CENTER ATTN AMSTA RS/D REES WARREN MI 48090 |
| 1 | DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL OP SD TL/TECH LIB 2800 POWDER MILL ROAD ADELPHI MD 20783-1197 | 1 | COMMANDER USA TANK-AUTOMOTIVE R&D CENTER ATTN AMSTA TSL (TECH LIBRARY) WARREN MI 48397-5000 |
| 1 | DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL OP SD TP/TECH PUB BR 2800 POWDER MILL ROAD ADELPHI MD 20783-1197 | 1 | GENERAL DYNAMICS LAND SYSTEMS DIV LIBRARY PO BOX 1901 WARREN MI 48090 |
| 1 | DIRECTORATE FOR MANPRINT ATTN DAPE MR DEPUTY CHIEF OF STAFF PERSONNEL 300 ARMY PENTAGON WASHINGTON DC 20310-0300 | 1 | PEO ARMORED SYS MODERNIZATION US ARMY TANK-AUTOMOTIVE CMD ATTN SFAE ASM S WARREN MI 48397-5000 |
| 1 | COMMANDER US ARMY RESEARCH INSTITUTE ATTN PERI ZT (DR E M JOHNSON) 5001 EISENHOWER AVENUE ALEXANDRIA VA 22333-5600 | 1 | COMMANDER US ARMY MATERIEL COMMAND ATTN AMCDE AQ 5001 EISENHOWER AVENUE ALEXANDRIA VA 22333 |
| 1 | DEFENSE LOGISTICS STUDIES INFORMATION EXCHANGE US ARMY LOG MGMT COLLEGE FORT LEE VA 23801-6034 | 1 | CHIEF ARL HRED ARDEC FIELD ELEMENT ATTN AMSRL HR MG (R SPINE) BUILDING 333 PICATINNY ARSENAL NJ 07806-5000 |
| 1 | HEADQUARTERS USA TRADOC ATTN ATCD SP FORT MONROE VA 23651 | 1 | CHIEF ARL HRED FT HOOD FIELD ELEMENT ATTN AMSRL HR MA (E SMOOTZ) HQ TEXCOM BLDG 91012 RM 134 FT HOOD TX 76544-5065 |
| 1 | COMMANDER US ARMY MATERIEL COMMAND ATTN AMCAM 5001 EISENHOWER AVENUE ALEXANDRIA VA 22333-0001 | 1 | CHIEF ARL HRED USAFAS FIELD ELEMENT ATTN AMSRL HR MF (L PIERCE) BLDG 3040 ROOM 220 FORT SILL OK 73503-5600 |
| | | 1 | CHIEF ARL HRED TACOM FIELD ELEMENT ATTN AMSRL HR MU (M SINGAPORE) BUILDING 200A 2ND FLOOR WARREN MI 48397-5000 |

NO. OF
COPIES ORGANIZATION

ABERDEEN PROVING GROUND

- 5 DIRECTOR
US ARMY RESEARCH LABORATORY
ATTN AMSRL OP AP L (TECH LIB)
BLDG 305 APG AA
- 1 LIBRARY
ARL BUILDING 459
APG-AA